TRAINING PROGRAMME IN CONTENT CUM METHODOLOGY OF TEACHING PHYSICAL SCIENCES AT SECONDARY LEVEL

(TRAINING PROGRAM FOR LECTURERS FROM COLLEGES OF TEACHER EDUCATION FROM TAMILNADU)

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Preface

A five day training program conducted at the request of the State of Tamilnadu, from 3rd March to 7th March, 2003, to orient teachers from Colleges of Teacher Education in content cum methodology of teaching Physical Sciences at the Secondary level.

The Objectives of the programme were to:

- enrich their content competence
- create an awareness of the nature, method of science and concept formation
- train them in content analysis
- present a unit plan, lesson plan & unit test and evolve them through group work
- illustrate how microteaching can be used to develop different skills of teaching
- discuss the importance of and organization of investigatory projects in physical science
- introduce them to the methods laboratory and organization of laboratory work
- discuss the importance of developing low cost teaching aids and their demonstration

To fulfill the objectives the programme was organized in two phases , the details of which have been reported here. We hope that the formats for the unit plan, lesson plan, unit test and sample lesson plans given here will be of use to Teacher Educators belonging to the Colleges of Teacher Education.

I would like to thank NCERT for supporting the programme financially, Prof. G.Ravindra, Principal, RIE, Mysore, and, all my colleagues involved in the program for their constant support in all the activities related to the programme.

P.R.Lalitha
Academic Coordinator

LIST OF RESOURCE PERSONS

1. Dr P.R.Lalitha,
   (Academic Coordinator)
   Reader in Physics, DESM,
   RIE, Mysore.

2. Dr R.Narayanan,
   Reader in Physics, DESM,
   RIE, Mysore.

3. Dr M.N.Bapat,
   Reader in Physics, DESM,
   RIE, Mysore.

4. Mr N.R.Nagaraja Rao,
   Senior Lecturer in Physics, DESM,
   RIE, Mysore.

5. Dr B.S.Raghavendra,
   Reader in Chemistry, DESM,
   RIE, Mysore.

6. Dr G.R.Prakash,
   Co-Coordinator
   Senior Lecturer in Chemistry, DESM
   RIE, Mysore.

External Resource Person

Mr P.R.Rao,
Reader in Physics (Retd),
RIE, Mysore.

LIST OF PARTICIPANTS

1. Sheila Bose,
   Lecturer (S.G) in Mathematics,
   Lady Willington IASE,
   Chennai 600 005 (TN)

2. S. A. Annie Isabella,
   Lecturer (S.G) in Education,
   Lady Willington IASE,
   Chennai 600 005 (TN)

3. S. Umarani,
   Lecturer (S.G) in Physical Science,
   Government College of Education,
   Pudukottai 622 001 (TN)

4. P. Latha,
   S.S. Lecturer in Physical Science
   Annamalai College of Education for Women,
   Thoothukudi 628 003 (TN)

5. A. Dhasnevis,
   Lecturer (S.G) in Physical Science,
   St. Ignatius College of Education,
   Palayamkottai 627 002 (TN)

6. Dr. A Amalraj
   Reader,
   St.Xavier's College of Education,
   Palayamkottai, 627 002 (TN)

7. M.Jagannathan,
   Lecturer in Physical Science,
   Government College of Education,
   Komarapalyam 638 183 (TN)

8. Dr. R.Uma,
   Sr. Lecturer in Physical Science,
   Lakshmi College of Education,
   Gandhigram, 624 302 (TN)

LECTURES DELIVERED BY THE RESOURCE PERSONS

Name	Initials	Topics discussed
Physics Dr P.R.Lalitha, Reader	PRL	Low Cost Materials for Science Education, their preparation& demonstration Presentation of Unit Plan and Lesson Plan
Dr M.N.Bapat, Reader	MNB	Investigatory Projects in Physical Science
Mr. N.R.Nagaraja Rao, Senior Lecturer	NRN	Preparation of a Unit Test And Blueprint
Dr R. Narayanan Reader	RN	Group Work on Preparation of Unit Plan & Lesson Plan
Chemistry Dr B. S. Raghavendra, Reader	BSR	Concept development through demonstration
Dr G.R.Prakash, Senior Lecturer	GRP	Problem Solving in Physical Science
Education Dr V.D.Bhat	VDB	Skills and Strategies of Teaching
External Resource Person Mr. P. Ramachandra Rao	PRR	Unit Planning and Lesson Planning

PROGRAMME SCHEDULE
Training Program in Content –cum- Methodology of Teaching Physical Sciences
3rd - 7th March, 2003

Day and Date	9.00 am to 10.00 am	10.00 am to 11.00 am	11.15 am to 1.00 pm		2.00 pm to 4.00 pm	4.00 pm to 5.30 pm
3.3.2003 Monday	Registration	Inauguration & Discussion with the Participants Physics Faculty	What is Science ? and the Method of Science PRR		Lab.Work PRL+PRR	Presentation PRL+PRR
4.3.2003 Tuesday	Learning and Information Processing PRR		Concept formation through Demonstration BSR		Content Analysis BSR+PRR	Group Activity PRL+PRR
5.3.2003 Wednesday	Skills and Strategies of Teaching VDB		Presentation of Content Analysis PRR+NRN		Unit Plan & Lesson Planning PRR+PRL	Preparation of Unit Plan & Lesson Plan PRR+RN
6.3.2003 Thursday	Problem Solving GRP	Presentation of Unit Plan & Lesson Plan PRR+PRL	Investigatory Projects MNB		Lab. Work BSR+GRP	Lab. Work BSR+GRP
7.3.2003 Friday	Preparation of Unit Test NRN	Preparation of Unit Test PRR+PRL	Group Work on Unit Test PRR+PRL		Preparation of Teaching Aids PRL	Demonstration of Teaching Aids PRL & Valedictory

A word about the Programme.......

The training programme was organized in two phases.

Phase I : A three day workshop was organized in the month of January, 2003, from 6th to 8th, During the workshop the topics to be discussed were identified and the tentative program schedule was drawn up. After going through the science textbooks of Tamilnadu , Kerala and the CBSE Schools it was decided that a sample unit plan, lesson plan and unit test should be developed on the topic Forces in Nature. It was also decided that the unit plan should reflect objectives related to self study by the students, the lesson plan should contain a pool of questions related to the self study, the unit test should contain questions on the portion allotted for self study. A sample unit plan, lesson plan and a unit test was prepared for use during the programme. The resource persons felt that the participants should be exposed to the methods laboratory and that they should be assigned group work to develop unit plans, lesson plans and unit test.

Phase II: In this phase the actual programme was conducted between 3rd and 7th March, 2003. Eight participants from the different Colleges of Teacher Education participated in the program. The detailed schedule of work is presented in the report. The program was inaugurated by Dr. G.Ravindra, Principal, RIE, Mysore on the 3rd of March 2003. This was followed by a discussion by Mr P.R.Rao on What is science and the method of science. The main aspects of the interaction included the nature of science and the steps of the scientific method. He also stressed how science contributes to the development of the mind and the importance of activity oriented teaching, scientific attitude and the major worldwide objective of scientific literacy. In the afternoon session the participants were involved in laboratory work in the methods laboratory. To begin with the importance of formulating a hypothesis as a starting point on the basis of observation was illustrated by demonstrating the air-bubble experiment. The participants then worked in four groups and performed four different experiments including the air bubble experiment as a follow up activity.

Later a presentation was made by the participants on the experiments conducted by them.

On the second day the 4th March, 2003 during the morning session Mr P.R Rao emphasized the importance of measurement and open ended experiments. He also illustrated the activity based approach to teaching through a few selected simulated experiments. The importance of relation between stimuli that the children are exposed to, sense perceptions, information processing and concept formation was stressed. Outputs in the form of behavioral changes was explained which was an important aspect of "Teaching Science for Understanding". Concept formation through demonstrations was discussed by Dr B.S.Raghavendra selecting the topic "Redox Reactions" and started the discussion choosing the reaction between silver nitrate solution and copper wire. A number of other reactions were also demonstrated followed by sequential questions.

In the afternoon session the participants were introduced to pedagogic content analysis and divided into two groups depending in their field of specialization. They selected two topics for doing the content analysis. They were Magnetism and Chemical Pollution.

On the third day the 5th March, 2003, the morning session started off with a lecture on "Skills and Strategies of Teaching" by Dr V.D.Bhat. He shared with the participants the practical difficulties arising during microteaching sessions in the Colleges of Teacher Education. He also suggested the alternatives for practicing microteaching skills in the Colleges. In the next session in the morning the participants presented their exercise on content analysis.

The afternoon session that followed included a discussion on "Unit Planning" and "Lesson Planning" using the plans prepared for the purpose on "Forces in Nature". Participants later on worked on preparing unit plans and lesson plans on the topics they had chosen for the content analysis, to maintain continuity. The formats used for developing lesson plans and unit plans in different Universities was also discussed.

The fourth day, the 6th March, 2003 stared off with a discussion Problem Solving as an approach to teaching and its importance was discussed by
Dr. G.R.Prakash. This was followed by a discussion of the Unit plans and Lesson plans prepared by the participants. The latter half of the morning session concluded with a lecture cum demonstration on investigatory projects like rate of burning, journey of objects through various liquids and the health of the eye.

During the afternoon session the participants performed some interesting experiments in Chemistry in the Chemistry methods laboratory. They also visited the Mathematics Laboratory.

On the fifth day, the 7th March, Preparation of a Unit test was discussed by Mr N.R.Nagaraja Rao using the sample test prepared on "Forces in Nature" which was followed by an exercise on Unit test preparation.

In the afternoon session Dr P.R.Lalitha, highlighted the importance of preparation of Teaching Aids and use of improvised aids to teach science. She stressed the fact that one should not be under the impression that a science laboratory is always necessary to teach science. Science taught using improvised aids should never be considered as diluted science. The participants were shown the teaching aids available in the Physics section.

PLANNING FOR EFFECTIVE TEACHING

Need for Planning

There is a need for intelligent planning of every lesson. It implies acting with a purpose. A plan can be called a blueprint which helps in the efficient, economical and smooth conduct of any activity. If teaching is to be effective in terms of learning by the students, it is necessary to ensure this through careful advance planning which would involve visualizing the entire teaching- learning situation, as it is likely to develop in the classroom. Every teacher has some specific purpose in teaching a unit or a topic. He strives to achieve these purposes during the course of the lesson. He needs to think about the best possible manner in which he can realize these purposes with the maximum of efficiency and the minimum of waste of available resources. This holds true for all teachers and especially to trainees in teacher training institutions. A teacher training program is geared towards development of a number of teaching competencies in the trainees. In order that practice teaching be effective it is important that development of the ability of a student teacher to plan a lesson is of great value and needs to be specifically addressed to in a teacher training programme.

Unit Planning and Lesson Planning

The learning activities and experiences that are to be provided in a classroom can be planned in two stages, first as `units` and then as `lessons`.

A `unit` is an organization of various activities, experiences, types of learning around a central theme, problem or purpose. It can be viewed as a meaningful whole of content, which is built around a central concept. Examples of units are: Reflection of light at plane and spherical surfaces, Transmission of heat, Wave motion etc.

Unit teaching attempts to build a comprehensive study plan focused on learning experiences based on a single theme. It stresses broad areas of knowledge, skills and attitudes rather than a mere presentation or teaching of restricted skills. It is a more effective way of organizing material so that the student will have a better understanding of what is to

be taught. Planning in terms of units enables pupils to see the different lessons as an integrated whole rather as disjointed bits of information.

A unit plan should reflect the objectives, content analysis, prerequisite learning experiences and activities to be provided and a scheme of continuous evaluation. A sample unit plan is given here. The task then before the student teacher is to choose a suitable unit and plan for the unit as a whole.

Elements of a Lesson Plan

There are innumerable ways of preparing a lesson plan. However, it is important to recognize that a lesson plan has a distinct purpose in relation to good teaching and has to be followed. A plan must help the teacher to clarify the specific learning outcomes, in pupils, in relation to the topic and indicate how they are to be realized.

A good lesson plan may contain the following essential elements:

- Statement of instructional objectives and learning outcomes related to the topic. It is desirable that the objectives are stated in terms of changes in pupil behavior so that evidences for these changes may be sought.
- Selection and sequential organization of learning activities and accompanying questions in terms of the objectives.
- Selection of appropriate evaluation devices to evaluate the learning outcomes at different stages.

Structure of a Lesson Plan

A comprehensive lesson plan in it format may contain the following :

- Essential identification data at the top as regards the school, name of the student teacher, name of the cooperating teacher, name of the college supervisor, class, period, time, lesson number, subject and topic.
- Statement of the instructional objectives in terms of acquisition of knowledge, understanding, ability to apply, development of skills, attitudes appreciation, etc. in relation to the topic.

If the basic principle that all teaching and testing has to be objective based and learner centered is to be followed, with due emphasis on

student behavior in the process of learning as well as in the product, then the plan should contain a statement of the behavioral outcomes or learning outcomes. These should form the starting point for indicating the corresponding content, learning activity, evaluation devices and items etc., in a structured way. The content need not be spelt out in great detail nor every question be detailed under learning activities. As far as possible the learning activities can be given from the pupils point of view indicating the role of the teacher by implication. The aids, materials, etc to be used could also be indicated under learning activities. If necessary blackboard work and summary may be indicated in boxes. Evaluation items related to both process and product outcomes.can be given. A three column format may be followed as indicated in the sample lesson plan provided herein.

Explanation with reference to a Lesson Plan Format.

a) Objectives and Learning outcomes

The purpose of teaching science is not merely to impart information to pupils but to kindle their minds to activity – thinking, reasoning, interpreting, formulating hypothesis and the like. The content of science therefore is to develop a variety of learning activities through which the development of the mind can be attempted.

The teacher needs to decide the scope of the content in the topic chosen and the level of understanding required. He should decide whether he should take the students to the level of seeing relationship or discriminating under understanding or to the levels of reasoning, interpreting and predicting in the area of application. It is therefore clear that while planning to teach a topic one should be very clear of the instructional objectives and the specifications (learning outcomes) that are attainable in the available time.

b) Learning activities

A classroom is full of activity but the question that arises is that how many of them are planned activities to produce the desired learning outcomes. The teacher should use a number of resources like the charts, experiments and demonstrations, etc., and plan a number of activities around them. It is learning experiences alone that can promote learning in the classroom.

If the teacher is clear about the expected learning outcomes (specifications) then he can so structure his learning experiences as to result in them. A learning may result in more than outcome or many experiences may lead to a single outcome. In the lesson plan the learning activities are defined in terms of pupil development to highlight the importance given to the pupil in the classroom. Learning activities are provided at the different stages of the lesson - introduction, development, review and assignments. During review a 'round off ' is given to the lesson. The assignment planned is also challenging.

c) Evaluation Tools

The teacher needs to evaluate the progress of the lesson and so he uses questions or test items. These are the objective-based questions planned before hand with a definite purpose. These questions should be differentiated from the questions used incidentally in the classroom. In the lesson plan prepared only a few questions are written against certain learning outcomes, learning experiences and test items.

d) Place of Concepts

All good teaching results in the development of certain fundamental concepts and skills, which are inherent to the subject. Concept formation is a developmental process and involves information processing. Through the various learning experiences provided in the classroom and outside, a student acquires knowledge of the facts, principles, terms and skills. Whereas a fact, principle, a piece of information or a definition can be given by the teacher and memorized by the by the student a concept has to be developed through a sequence of learning experiences. The conceptual approach enables the teacher to formulate the concepts at the appropriate stage/s during the progress of the lesson. When the concepts are developed in the classroom, pupils develop sufficient understanding of the concepts in science and further proceed to apply the knowledge and understanding in new situations. A number of topics lend themselves to this approach and teachers should strive to use it to their advantage to develop a lesson.

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FORCES IN NATURE

UNIT PLAN

Teaching Points:

Universal Law of Gravitation $F = \frac{Gm_1m_2}{r^2}$

Acceleration due to gravity $g=\frac{GM}{R^2}$ (usual notation)

Concept of weight, apparent weight and weightlessness
Frictional forces in solids and their types: Static, sliding, rolling
Causes of friction
Advantages and disadvantages of friction
Methods of reducing friction
Viscous force – frictional forces in fluids
Surface tension and its explanation on the basis of molecular theory
Phenomenon of capillarity
Applications of surface tension
Elastic forces
Electrostatic force and its comparison with gravitational force
Magnetic force
Classification of forces in nature (gravitational, electric, magnetic, strong and weak interactions)

Instructional Objectives

1. Infer the Universal Law of Gravitation $F = \frac{G\,m_1 m_2}{r^2}$
2. Infer that due to gravity near a large body is the same for all bodies (feather and coin)
3. Give reasons for why a freely falling body seems to be weightless
4. Define the term weight
5. Generalise that frictional forces exist when a body tends to slide/ move/ roll over another surface
6. Identify the causes of friction
7. Explain the term viscosity
8. Infer that every free liquid surface has a tangential force in it which tends to contract it (surface tension)
9. Define capillarity
10. See relationship between capillary rise and the radius of the tube
11. Give reasons for capillarity
12. To infer that internal forces are developed when bodies are deformed (elastic)
13. To compare the electrostatic force and the gravitational force between an electron and a proton in an atom
14. To classify the forces in nature into categories (gravitational, electromagnetic)
15. To recall the terms strong and weak interactions

Instructional Objectives for self learning by students

1. Cite examples for gravitational force. Solving numerical problems by substitution
2. To derive $g = \frac{GM}{R^2}$
3. To distinguish between g and G
4. To distinguish between mass and weight
5. To list out the advantages and disadvantages of friction
6. To suggest methods for reducing friction
7. a) To cite examples for viscous forces
   b) To suggest a method for reducing viscous forces
8. To cite examples for surface tension
9. To cite examples for capillarity from daily life
10. To suggest the practical use of capillarity
11. To classify substances into elastic and plastic

Instructional Objectives	Strategies/Methods	Materials required	Learner`s Activity
Gravitational Force:			
1. Infer the Universal Law of Gravitation	Discussion	Using Pictorial Representation	Solving numerical problems Citing examples for gravitational force
2. Hypothesise that acceleration due to gravity near a large body is the same for all bodies	Discussion	-do-	Derivation of $g = \frac{GM}{R^2}$ (Hint: Use Newton`s II Law and Universal Law of Gravitation)
3. Give reasons why a freely falling body appears to be weightless	Discussion		To distinguish between `g` and `G` To distinguish between mass and weight Derive that $W = m\left(\frac{GM}{R^2}\right)$
Frictional Force			
4. Generalise that frictional forces exist when bodies slide, roll or move over one another	Demonstration of Experiments Discussions	Spring, weights, surfaces, dowels, cart	Cite examples from everyday life situations

Instructional Objectives	Strategies/Methods	Materials required	Learner`s Activity
5. Identify causes of friction	Discussion		Suggest advantages and disadvantages of friction Suggest methods of reducing friction
6, Explain the origin of viscous forces	Discussion		Cite examples for viscous forces Identify the factors affecting viscous forces Streamlining as a method to reduce viscous forces
7. Infer the definition of surface tension	Demonstration/Group Activity	Shaving brush Soap Solution Thread, ring and loop Liquid drops in burettes/pipettes	Cite examples for surface tension Suggest practical use of surface tension Needle or blade being placed on water surface
8. Explain surface tension on the basis of molecular theory	Discussion		Determining the area of a rectangle, square and a circle of the same perimeter on a graph sheet and finding which has the maximum area Book activity No: 2&3
9. Define capillarity	Demonstration		Cite examples for capillarity phenomenon Give reasons for Farmer tilling the soil before summer Turning the soil near the plants by the gardener

Instructional Objectives	***Strategies/Methods***	**Materials Required**	**Learner`s Activity**
			Absorption of nutrients by plants
10. See relationship between capillary rise and radius	Demonstration		
11. Account for capillarity			
12. To infer that internal forces are developed when bodies are deformed (elastic)	Demonstration cum discussion	Spring scale, weights, rubber ball	Classify substances into elastic and plastic
13. To compare the electrostatic force and gravitational force between an electron and proton by calculation	Discussion (only order need be discussed)	Data, watch glass, meter scale, plastic comb/rod/fur	
14. Classify the various forces in nature into different categories	Discussion		Cite examples for electric, magnetic and electromagnetic forces
15. Recall terms- strong and weak interactions	Teacher gives information		

LESSON PLAN

Class IX **No. of Periods: 2**

Instructional Objectives:

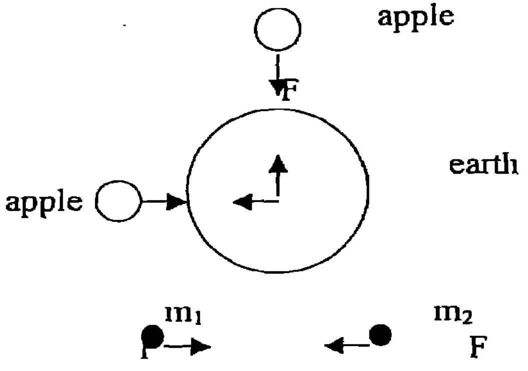
1. To acquire the knowledge of the term "Universal Gravitational Constant", and its unit
2. To understand the Universal Law of Gravitation, independence of acceleration of acceleration due to gravity on mass of falling bodies, concepts of weight, apparent weight and weightlessness

Teaching Points

1. The force of attraction between two bodies (considered to be point masses) is
    i. directly proportional to each of the masses (product of their masses) and
    ii. inversely proportional to the square of the distance between them
2. The Universal Gravitation Constant is numerically equal to the gravitational force experienced by either of the two bodies each of mass 1kg when placed 1 metre apart. Its unit is $Nm^2 kg^{-2}$
3. All freely falling bodies have the same acceleration due to gravity
4. i. The weight of the body is equal to the force exerted by the earth on the body with respect to the earth or very heavy bodies such as moon, sun, etc.
    ii. The apparent weight of the body is the ability (acquired due to the weight of the body) to press on the surface which freely supports it.
5. All freely falling bodies appear to be weightless.

Materials required

1. Chart depicting dependence of the force of gravity on i. the masses of the two bodies involved; ii. distance separating them; iii. the nature of the medium in which the bodies are placed.

Expected Learning outcomes	Sequential Learning Experiences	Evaluation Items
1. Introduction	An apple is falling from the tree. Describe its motion (path, speed and direction). What causes its acceleration ? Which applies the force on the apple ? Does the apple exert force on the earth ? What is the line of action of the force ? Draw the diagram  	

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation Items
Announcement of the topic	Give some more examples for the gravitational force. Do you exert force on your friend sitting next to you? **Let us study about gravitational force** Teacher presents the chart1 depicting the magnitude of the force as a function of the distance. Compare the lengths of the force vectors as the distance between the bodies increases	
See relationship: force of attraction between two bodies is inversely proportional to the square of the distance. $F \propto 1/d^2$ (masses are the same)	What can you conclude from this?	Refer to chart 1. What is the force if d is increased 5 times? The distance between two bodies is halved. What happens to the force between them ?
See relationship: force of attraction between two bodies is directly proportional to the product of the masses $F \propto m_1m_2$ (distance is the same)	Teacher presents the chart 2 depicting the magnitude of the force as a function of the masses of the bodies, keeping the distance same. Compare the lengths of the force vectors as masses increase.	Refer to chart 2. What is the force if $m_1=2m$ & $m_2=m/2$?

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation Items
See relationship: force of attraction between two bodies is not dependent on the property of the medium in which they are placed, keeping d constant $F \propto \frac{m_1m_2}{d^2}$ $= G\frac{m_1m_2}{d^2}$	Teacher presents the chart 3 depicting the force when the bodies are placed in different media- vacuum, air, water, m_1,m_2 and d being the same. Let us combine the results. Write the relation as an equation.	Two bodies each of mass m are separated by a distance r. If the masses are doubled and the distance separating them is also doubled what is the force?
Recall G as the Universal Gravitational Constant and its value $G=6.67x10^{-7}$ Nm^2kg^{-2} Defines G as the value numerically equal to the force between two bodies each of mass 1kg placed 1m apart.	The teacher names the constant of proportionality and gives its value. Discusses the definition of G (What is F if m_1 = m_2 = 1kg and d = 1m?) Teacher informs that this law was formulated by Newton.	Define G. What is its unit?

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation Items
State the Universal Law of Gravitation : The force between any two bodies is directly proportional to the product of the masses and inversely proportional to the square of the distance between them	State Newton`s Law of Universal Gravitation)	State Newton`s Law of Universal Gravitation
Define weight as the force of attraction of the earth on this body Identifies weight as a vector quantity directed towards the center of the earth Recalls the unit of weight as Newton	Teacher introduces the terms `weight` of a body. What type of quantity is it ? What is its unit ?	Give the definition of weight
Establishes the relationship $W=\frac{GMm}{R^2}$ Establishes the relation W=F $\frac{GMm}{R^2} = mg$ $g = \frac{GM}{R^2}$ M = mass of the earth, R= radius of the earth	How do we use the Newton`s Law of Universal Gravitation to calculate the acceleration of an apple in free fall What is the force on the apple due to the earth ? (weight= W ) If the acceleration is `g~, from Newton`s second law, what is the force on the apple? How do these two expressions for the forces compare? Find the expression for `g` the	Calculate the weight of a 30 kg body on the surface of the moon (g =1.6 ms^{-2}) In the expression $g = \frac{GM}{R^2}$, if g is the acceleration due to gravity near the moon`s surface, what do M and R represent ?

Expected Learning outcomes	Sequential Learning Experiences	Evaluation Items
	acceleration due to gravity. This expression can be used to find the value of `g` on the surface of any near body	
Compares the gravitational forces on the masses Recalls the expression for acceleration from Newton`s II Law. Infer the acceleration due to gravity is the same for all freely falling bodies Identify that velocity of impact & time of flight are the same for both bodies	Bodies of different masses are released simultaneously from a given height. How do their `g`s` compare ? Suppose that two bodies of masses 1kg and 5kg are dropped from a given height simultaneously, what is the acceleration acquired? time of flight? velocity of impact on the ground ? Will the acceleration of the 5kg mass be 5 times that of the 1kg mass ? Acceleration of the 1kg mass $= \frac{F}{m}$ Acceleration of the 5kg mass $= \frac{5F}{5m} = \frac{F}{m}$ What is your answer ? What do you say regarding the time of flight and velocity of impact with the ground? Teacher narrates the experiment suppose to have been performed by Galileo fro the top of the Pisa Tower.	

Expected Learning outcome	Sequential Learning Experiences	Evaluation Items
Recall from experience that leaf reaches the ground later than the stone. Its path may not be a straight line and leaf may flutter as it falls. Guess that the air resistance may be a factor	Suppose that a leaf and a stone were dropped from a height. Which one will reach the ground earlier? Is this situation different from the above one? Teacher narrates the feather and coin experiment and states the result. a. Both the feather and the coin reach the bottom of the tube simultaneously	A, drops a stone of 2kg mass from the first floor. At the same time B drops a 4kg mass from the second floor. Compare the acceleration of the stones. (Compare the times of flight and the velocity of impact, assuming the height of the floors from the ground to be h and 2h respectively)
Infer that in the absence of resistance of the medium, all bodies will have the same value for the acceleration due to gravity Infers that the reading shown by the balance is a measure of the platform's (of the balance) reaction on the body which (by Newton's Third Law of motion) is equal and opposite to the body's ability to press the platform; which in turn, is due to the earth's gravitational force on the body (weight)	b. When the tube contained air, the coin reached the bottom first and the feather later What do you conclude ? How does one measure his weight? What does one use? When one stands on the platform of the weighing balance, what does one do to the balance? What enables one to press on the balance? The reading on the balance is due to the force on the spring. What does the balance reading indicate?	

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation Items
Defines apparent weight as the ability of the body to press the surface which freely supports it	Teacher introduces the term "apparent weight"	What does the spring balance actually measure?
Recognise the unit as kg-wt (kilogram weight) or kgf (kilogram force) Calculates $1\text{kgf} = 1.0\text{kg} \times 9.8\ \text{ms}^{-2}$ $= 9.8\ \text{N}\ (\text{kg ms}^{-2})$ $\approx 10\ \text{N}$ ($g = 9.8\ \text{ms}^{-2}$ is the acceleration due to gravity) Identify that if the entire gravitational force is available for pressing the surface which freely supports it then weight = apparent weight. Identify that the location is at the poles Give reasons (i) At any latitude as the earth rotates, the	What is the unit of apparent weight in practice? Convert this into SI unit When does the weight equal the apparent weight ? At what location on the earth does this happen ? Why ? Suppose W_p is the balance reading at the poles and W_L is the reading at any latitude	

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation Items
Body is undergoing circular motion (ii) This requires centripetal force. (iii) This comes from the earth's gravitational force of attraction on it (iv) The body is left with less gravitational force to press on the surface.	We find $W_L < W_p$ How do you account for the same? (assume the earth to be exactly spherical)	
Compares apparent weight at any latitude to be less than that at the poles Identifies the latitude to be zero (i.e. at the equator) for minimum apparent weight	At what latitude is the apparent weight a minimum	W_P, W_l, & W_E are the readings of the balance when a body's weight is measured at the poles , latitude of 450 and the equator. Arrange these values in the increasing order. Account for your answer
Verify that the balance reading is the same when weighing is done 1. outside the lift 2. inside the lift which is at rest, and 3. inside the lift which is moving with constant speed (up or down)	Suppose now that the weighing is done inside a 'lift'. What does the balance read when the lift is 1. At rest 2. moving up or down with constant speed? (Remember that the state of rest is a special case of the case of motion with constant speed, which is zero) What happens to the reading of the balance when the body is in accelerated motion.	

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation Items
Identify that both the balance and the mass are falling freely Guess that the balance reading is zero	Teacher draws their attention to the following situation: Suppose that the balance is placed on a plank across a pit and a person standing on the balance records his weight as 60 kg. Suppose that the plank is you think will happen to (i) the balance	One end of a spring is tied to a support by a string. Body is suspended from the other end. The spring shows a reading 2.0 kg. What does it represent ? The string is suddenly cut using a pair of scissors. What is the new reading of the spring? Explain
Give reason that 1.Force is necessary to cause acceleration due to gravity 2. The earth's gravitational force (weight) is the cause of acceleration 3. The body is not able to press on the platform of the balance	(ii) to the person and (iii) to the reading on the balance How do you account for your answer? What is the cause for the acceleration? What provides this force? What happens to the ability of the body to press the platform of the balance	

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation Items
Identify that the earth's pull weight acts all the time (i.e. when the body is at rest, or moving with constant speed or accelerating	When the body is accelerating has the earth stopped attracting the body?	
Infer that a body in free fall appears to be weightless	Teacher introduces the term weightlessness	What is weightlessness ?
Recall (i) an astronaut orbiting the earth in a spacecraft (ii) a lift falling freely when its cable gets cut	Teacher gives a few examples	Give any two examples of weightlessness
Recalls that gravity plays an important role in blood distribution in the body. One reaction to apparent weightlessness is a decrease in the volume of blood through increased excretion of water. Astronauts, returning to the earth have experienced temporary impairment of their sense of balance and a greater tendency toward morning sickness	Teacher gives the physiological effects of prolonged weightlessness on human beings (optional).	

Review:

1. State Newton's Law of Universal Gravitation.
2. Write the formula.
3. Define the term, ' Gravitational Constant'. What is its unit? Why is it a universal constant ?
4. All freely falling bodies.................(complete the sentence)
5. State the definition of weight, apparent weight. What type of quantity is it and What are its units ?
6. When do bodies appear weightless ?

Assignment and pool of questions:

1. Why is it that two persons stationed closeby do not feel the gravitational force of attraction? When does it become appreciable?
2. Draw the diagram of two body systems such as the earth and moon, sun and earth, and represent the gravitational forces.
3. How is the gravitational interaction different from the electrostatic or magnetic interaction?
4. Based on the Newton's Law of Universal Gravitation, give another definition of mass. How is it measured? On what does it depend?
5. Explain the term 'acceleration due to gravity' ? What is its value on the surface of the earth?
6. Distinguish between 'G' and 'g'.
7. If the earth were a perfect sphere, will 'g' vary from the equator to the poles? How?
8. How does 'g' vary (i) as one goes away from the surface of the earth and (ii) as one goes deeper and deeper into the earth.
9. What is the value of 'g' at the center of the earth? Explain.
10. What will be 'g' on the surface of the moon? (mass of the moon ~ (1/80) mass of the earth; radius of the Moon ~ (1/10) times that of the radius of the earth. 'g' on the surface of the earth ~ $10ms^{-2}$.

11. Suppose a feather and a coin were dropped by the astronaut from a height onto the surface of the Moon. How are the observations there different from that on the earth? (Hint: Moon has no atmosphere!)
12. 'g' on the surface of the moon is 1/6 of that on the earth. What is the weight of a person of mass 50 kg there ? If that person lifts a load of 50 kg on earth, what load can be lifted there?
13. A stone is tied to a folded umbrella and the combination is dropped from a height. Next the same combination but with the umbrella open is dropped from the same height. Compare the values of the acceleration in the two cases. Can you call the acceleration in the second case as acceleration due to gravity?
14. Distinguish between mass and weight.
15. Why do skydivers use parachute during diving ?
16. Draw graphs to show the dependence of gravitational force on (i) distance and (ii) product of the masses (Ref. Charts 1 and 2).
17. Define the term weightlessness.
18. In the relation F=ma, to what property is m related?
19. Cite some more examples for gravitational forces.
20. What does a balance measure? Under what conditions does the balance indicate the weight of the body.
21. Using Newton's second law of motion and his Law of Universal Gravitation, show that acceleration due to gravity on the surface of an astronomical body is $g = \frac{\sqrt{(GM)}}{\sqrt{R^2}}$ M= mass of the body; R= radius of the body.
22. A 10 kg mass is falling when air resistance is 20N. What is the acceleration of the body? (magnitude and direction).
23. Earth is flattened at the poles and bulging at the equator. What is its effect on the weight of the body?
24. An astronaut is strapped to his seat in the space shuttle atop the rocket. How does he feel regarding his weight when the rocket is being fired? Explain.
25. What motion of a lift makes one feel 'heavy' (feeling a greater strain in the legs and feet) and 'light' (with regard to feeling of changing weight. Explain.

PREPARING A UNIT TEST

After teaching a unit, it is imperative that the teacher makes sure of the extent to which the objectives, for which the whole unit had been planned, have been achieved. The unit test is designed to help him in this task. A unit test is nothing but an achievement test, which serves the purpose of evaluating the learning outcomes of the whole unit. To accomplish this the unit test should include: design and blueprint, the test, scoring key, marking scheme and question-wise analysis of the test. The design should show the weightages assigned to the different objectives, content and number and form of items to be included in the test. The items should not be written in a random manner but in a planned manner with reference to the specific objective to be tested and the precise content area. It is also necessary to prepare a scoring key and a marking scheme. At this stage, faulty items can be detected and corrected. Finally a question-wise analysis chart has to be prepared. The chart should show against each item its objective, specification, topic, form, estimated difficulty level, marks and time required to answer it. A specimen unit test has been included which reflects the design, the blueprint and the unit test.

UNIT TEST

FORCES IN NATURE

A. Content Analysis

	Classroom **Weightage 70%**	**No. of periods**
UNIT I	(1) Gravitational Force: Law of Universal Gravitation and Acceleration due to gravity (2) Frictional Force: Types and causes	2 1
UNIT II	Viscous Forces: Viscosity and surface tension – definitions – explanation on molecular theory – capillarity – reasons	2
UNIT III	Elastic Forces: Origin of elastic forces – deformation E.S. forces	1
UNIT IV	Comparison and classification of forces: gravitational, electrostatic, magnetic force	1
UNIT V	**Self Learning Weightage 30%**	3
	Total	10

B. Design of Blue Print

Total Marks: 20 **Total Time : 45 mins**

a. Weightage to Content

Units	No. of Periods taught	Marks allotted in Question Paper	Time allotted in minutes
Unit I	3	6	12
Unit II	2	4	8
Unit III	1	2	4
Unit IV	1	2	4
Unit V	3	6	12
Total	**10 periods**	**20 marks**	**45 minutes**

b. Weightage to Objectives

Objectives	Percentage Marks	Marks
Knowledge	40	8
Understanding	30	6
Application	20	4
Skill	10	2

c. Weightage to types of questions:

Type of Question	Percentage Marks	Marks for each question	Number of Questions	Total
Very Short Answer	20	1	4	4
Short Answer	50	2	5	10
Long Answer	30	3	2	6
Total	100		11	20

C. Blue Print

Total Marks: 20

Total Time: 40 min + 5min (revision)

Objectives →	Knowledge			Understanding			Application			Skill					
Weightage to objectives →	40% (8 marks)			30% (6 marks)			20% (4 marks)			10% (2marks)			Q	M	T
Topics ↓	VSA	SA	LA	VSA	SA	LA	VSA	SA	LA	VSA	SA	LA			
Gravitational and Frictional forces					${}_{2}1_{4}$		${}_{1}1_{2}$		${}_{3}1_{6}$				3	6	12
Viscous forces	${}_{1}1_{2}$				${}_{2}1_{4}$								2	3	6
Elastic and other forces		${}_{2}1_{4}$											1	2	4
Classification and comparison of forces					${}_{2}1_{4}$								1	2	4
Self Learning	${}_{1}2_{4}$		${}_{3}1_{6}$								${}_{2}1_{4}$		4	7	14
Q	3	1	1	-	3	-	1	-	1	-	1	-	11	-	-
M	3	2	3	-	6	-	1	-	3	-	2	-	-	20	-
T	6	4	6	-	12	-	2	-	6	-	4	-	-	-	40

${}_{1}2_{4}$ Left subscript indicates marks for each question, right subscript indicates total time needed to answer, central digit indicates the number of questions

Demonstration School, Mysore
UNIT TEST
Class IX

Time: 45min **Max. Marks:20**

I. Answer the following in a word or two or at the most one sentence: 1×4=4marks

1. Why is it that two persons do not feel the gravitational attraction, however close they are ? When is this attraction appreciable?
2. What is the instrument used to measure one`s weight? In what unit is weight measured?
3. What method is used to reduce friction in
   a. a wheel and axle
   b. jet planes and race car
4. How does the surface tension of a liquid change when soap is added into it? What is its use in daily life?

II. Answer the following in a sentence or at the most two sentences: 2×5=10 marks

1. Two masses 10kg and 20 kg are allowed to fall from a tower 100m high, simultaneously. Which of the two will reach the ground earlier?. By how much ? Which of the two will travel faster? By how much ? Give reasons.
2. The branch of a tree is pulled and released. What change is noticed? What kind of force brings about this change ?
3. Two droplets of mercury kept on a glass sheet form a larger drop without sticking on to glass. Explain why ?
4. Two masses of 2kg and 8 kg are 3m away from each other. A 1kg mass is brought in between these two at a distance of 1m from the smaller mass. Represent the forces on 1kg. What is the net force on this mass ?
5. Name the type of forces involved in the following situations
   a. A ball thrown vertically upwards
   b. Iron filings cling to the poles of the magnet
   c. An electron attracts a proton
   d. A stamp sticks on to an envelope

III. Answer the following:

1. What will be the value of `g` on the surface of the moon? What is the weight of a person of mass 50kg on the moon?
[Mass of the moon = (1/81) times the mass of the earth,
Radius of the moon = (1/11) times the radius of the earth,
`g` on the earth = $10ms^{-2}$] **3 marks**

2. Explain why farmers turn and loosen the soil especially during summer. **3 marks**

APPENDIX

SAMPLE UNIT PLANS AND LESSON PLANS PREPARED BY PARTICIPANTS

Subject :
Std : IX

UNIT : CHEMICALS AND ENVIRONMENT

Teaching Points :

Concept of Environment
Concept of Pollution
Sources of Pollutants
Types of Pollution – Air, Water, Soil
Causes of atmospheric pollution
Different types of atmospheric pollutants (CO, SO_2, NO_2)
Causes of water pollution (1,2,3)
Different types of water pollutants
Causes of soil pollution
Different types of soil pollution
Environmental pollution due to nuclear and radio-active wastes.
Health hazards due to pollution

Instructional Objectives : The Students

- identify environment (activity) explain, define, give examples.
- Define 'Pollution'.
- Identify the different types of Environmental Pollution (by showing pictures)
- Give reasons for pollution.
- Define pollutant.
- Classify the various pollutants in nature into categories.
- List out the sources of air pollution, water pollution and soil pollution.
- Explain the effect of *increase in* CO_2 *level in atmosphere.*
- Explain the toxicity of CO.
- Give reason for acid rain.
- State the effect of lead *pollutant on children's intelligence.*
- List the health hazards due to smoke.
- Explain the control measures to avoid smoke.
- Mention the ways of utilizing the garbage waste.
- Classify the health hazards of water pollution.
- Explain the phenomenon 'fluorosis'.
- Explain the measures to control pollution due to fertilizer, insecticides and pesticides.
- Explain the hazards due to nuclear pollution.

Instructional Objectives for Self-Learning by Students

- List out the sources of pollution in day-to-day life.
- Relate Global Warming with Green-House effect.
- Bring out the effects of leakage of gas (methyl isocyanide) at Bhopal.
- Give reasons for the health hazards in Hiroshima and Nagasaki during Second World War.
- Mention some non-conventional sources of energy.
- Differentiate between biological and chemical hazards of water pollution.
- Explain how the detergents pollute water and soil.
- List out few examples for pesticides, insecticides and fertilizers.
- Mention the places where tanneries and dyeing industries are situated in Tamil Nadu.
- Mark the nuclear power plants in India Map.
- List the radioactive elements used in different nuclear plants.
- Bring out your opinion on new nuclear power project at Koodankulam in Tamil Nadu.
- Prepare an album on effects of pollution.

Unit : CHEMICALS AND ENVIRONMENT (IX Std)

Instructional Objectives	Strategies/Methods	Materials Required	Pupil's Activity
Identify environment.	Discussion	Living situations, pictures.	Identifying the objects in their environment.
Define pollution.	Discussion	Living situations and pictures.	Exploring the different types of pollution.
Give reasons for pollution.	Discussion	Pictures	Identify the factors causing pollution.
Define pollutant.	Discussion	Blackboard writing, charts	Cite examples for pollutants.
Classify various pollutants.	Discussion	Specimen (polluted water, cigarette smoke)	Identify different types of pollutants.
List out source of pollution.	Discussion	Pictures and static models	Cite examples for various types of pollutants.
Explain the effect of increase in CO_2 in the atmosphere.	Discussion	-	Infer the term 'Global Warming'.

Instructional Objectives	**Strategies/Methods**	**Materials Required**	**Pupil's Activity**
Explain the toxicity of carbon monoxide.	Discussion	Chart	Suggest some techniques to reduce expulsion of CO.
Explain 'Acid Rain'.	Discussion	Stones, Statues, pictures of monuments (Taj Mahal)	Give reason for corrosion of marble monuments.
State the effect of lead pollutant.	Discussion	-	Cite examples where lead is used in daily life.
List the health hazards due to smoke.	Discussion	Pictures	List the control measures and preventive measures.
Methods of utilizing the garbage waste.	Demonstration	Vegetable wastes, leaves, cow dung, etc.	Participating in preparing bio-fertilizers.
Classify the health hazards due to water pollution.	Discussion	-	Cite examples for water pollution and diseases.
Explain fluorosis.	Discussion	Photos	-
Control measures for soil pollution.	Discussion	-	List out the various fertilizers, insecticides and pesticides.
Explain hazards due to nuclear pollution.	Discussion	Pictures	Identifying the diseases due to nuclear pollution.

LESSON PLAN

Name of the School :
Class : Std. IX
Name of the Teacher :

Period :
Duration : 40 minutes
Subject : Environmental Pollution
Topic : Air pollution

Instructional Objectives :

1. To acquire the knowledge of the terms Environment, Pollution and Pollutants.
2. To understand the different types of pollution.
3. To acquire the knowledge of sources and pollutants of air pollution.
4. To understand the causes and health hazards due to CO and CO_2.
5. To apply preventive and control measures.

Teaching Points :

1. Environment relates to our surroundings.
2. Pollution is contamination of Environment which is harmful to living and non-living things.
3. Pollutants are substances that cause pollution.
4. Types of pollution (Air, water, soil and nuclear).

5. Sources of Air Pollution (Domestic fire, power stations, factories, vehicles, decomposition of solid wastes, etc).
6. Different air pollutants (CO_2, CO, SO_2, H_2 S, oxides of nitrogen, lead compounds, bacteria and germs).
7. Causes and health hazards due to CO and CO_2.
8. Preventive and Control measures of air pollution.

Materials Required : Charts, pictures showing air pollution.

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation
Introduction	What do you see around you? What do you see when you go to a forest? What are the factors that affect the growth of environment?	
Announcement of the topic.	Let us study about the Environment and Pollution. Teacher shows the pictures of various environment and explains environment.	Define environment. Cite few examples.
Sees the difference between the polluted and non-polluted environment.	Teacher shows the pictures depicting the polluted environment.	Describe pollution.
Define pollutant.	The teacher shows specimen such as polluted water, smoke from cigarette, pesticides and describes pollutants.	What is a pollutant ?

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation
Observes the types of pollution.	The teacher explains the different types of pollution using charts, pictures.	What are the types of pollution?
Cites examples for air pollution.	The teacher lists out the sources of air pollution using models, pictures of factories, chimneys, and vehicles.	Mention some sources of air pollution.
Cites – examples for air pollutants.	The teacher explains the different types of air pollutants. - CO and CO_2, oxides of N_2, SO_2, H_2S, lead compounds, bacteria and germs.	Give two examples for air pollutants.
Give reasons for air pollution.	The teacher explains the incomplete combustion of fuels causing air pollution.	Reason out the causes for air pollution.
Sees the relationship. Increase in CO_2 level and climatic condition. Explains global warming.	The teacher explains the health hazards due to CO_2. She explains the relationship between the increase in CO_2 level and change in climatic condition.	Explains global warming.
Gives reason for CO poisoning of blood.	The teacher explains the health hazard such as CO poisoning in blood due to its inhalation.	Why is CO considered to be the cause of deadly air pollution ?

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation
Applies the preventive and control measures of air pollution in daily life.	The teacher explains the preventive and control measures of air pollution.	What are the preventive measures of air pollution? What are the controlling measures of air pollution ?

Review :

1. Define Environment.
2. Define Pollution.
3. What is pollutant ?
4. What are different types of pollution ?
5. Mention few sources of air pollution.
6. Give reason for Global Warming.
7. Name two main air pollutants.

Assignment and Pool of Questions

1. The dreadful air pollutant of car exhaust is ....
2. The main pollutants of air which are liberated from coal when it is burnt are ....and ....
3. What is environmental pollution ?
4. What are the factors that affect environment ?
5. What are the sources of air pollution ?
6. What are the effects of CO_2 when it is present more than the required percentage in atmospheric air ?
7. Why is carbon monoxide considered the deadly air pollutant ?
8. What are the main pollutants of air ? Explain in short the effects of these pollutants and the remedial steps taken to control them.

Unit Test :

1. The gas that makes our blood poisonous by combining with haemoglobin is ....
2. The gas that influences the temperature of the Earth's surface is ....(1)
3. Define environment. (2)
4. Explain in short the effects of the pollutants CO and CO_2 and the remedial steps taken to control them.

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SCIENCE (PHYSICAL SCIENCE)
Std : VIII
Unit No. 7 MAGNETISM

UNIT PLAN

Teaching Points :

Concept of Magnetic Field
Properties of a Magnet
Mapping of a magnetic field
Magnetic lines of force due to a bar magnet.
Lines of force and properties of lines of force.
Concept of Magnetisation
Comparison of soft and hard magnetic substances.
Molecular theory of magnetization
Weber elements
Comparison of magnetized and unmagnetised piece of iron.
Earth's Magnetism
Geographical axis of earth, Magnetic axis of the Earth

Instructional Objectives (Classroom)

2. Defines the concept of Magnetic field.
3. Explains the properties of a Magnet.
4. Demonstrates the magnetic lines of force due to a bar magnet.

5. Infers that there are two poles in a magnet – north and south.
6. Observes the magnetic lines of force.
7. Defines a lines of force.
8. Lists the properties of magnetic lines of forces.
9. Recalls the concept of Magnetisation.
10. Distinguishes the hard and soft magnetic substances.
11. Recognises the Molecular Theory of Magnetisation.
12. Recalls the term Weber element.
13. Compares magnetized and unmagnetised piece of iron.
14. Explains earth's magnetism.
15. Infers the geographical axis of the earth.
16. Recognises the magnetic axis of the earth.

Instructional Objectives for Self-Learning of Students

1. Gives examples for Magnetic Substances.
2. Draws magnetic lines of force using compass needle.
3. Demonstrates the magnetic lines of force using iron filings.
4. Reasons why steel nibs retain magnetism and iron clips lose magnetism.
5. Gives example for hard and soft magnetic substances.
6. Differentiates a magnetized iron piece from an unmagnetised iron piece.

Instructional Objectives	Strategies/ Methods	Materials Required	Required Activity
Mapping of a Magnetic Field :			
1. Defines the concept of magnetic field.	Discussion	Using real objects	Gives examples for magnetic substances.
2. Explains the properties of a magnet.	Demonstration and Discussion	-do-	Observes the magnetic lines.
3. Demonstrates the magnetic lines of a bar magnet.	Demonstration	Compass needle, bar magnet, drawing board and pencil	Draws the magnetic lines of forces.
4. Infers the North and South pole of a magnet.	Discussion	Two bar magnets.	Identifies the poles of a bar magnet.
5. Observes the magnetic lines of force.	Discussion	Magnet and Iron Filings	Observes the magnetic lines are crowded near the poles.
6. Defines the lines of force.	Discussion		Locates the path of a unit North pole.
7. List the properties of the magnetic lines of force.	Discussion		Observes that the magnetic lines are not crossing each other.
Magnetisation :			
8. Recalls the concept of Magnetisation.	Discussion and Demonstration	Charts, steel pen nibs, iron clips, bar magnet.	Sees the chained nibs do not fall apart but the clips are far from each other.

Instructional Objectives	Strategies/ Methods	Materials Required	Required Activity
9. Recognises the molecular theory of magnetization.	Discussion	Charts	Infers that each molecule of a magnetic substance behaves like a tiny magnet.
10. Recalls the term Weber elements.	Discussion		Identifies small piece of magnetic elements and molecular magnet.
11. Distinguishes the hard and soft magnetic substances.	Discussion.	Charts	Gives example for hard magnetic substances and soft magnetic substances.
12. Compares the magnetized and umagnetised piece of iron.	Discussion	Charts	
Earth's Magnetism :			
13. Explains earth's magnetism.	Discussion Demonstration	Chart Magnetic Needle	Infers that the earth behaves like a huge magnet. Identifies earth's north and south poles.
14. Infers geographical axis of the earth.	-do-		Locates the geographical axis of earth.
15. Recognises the magnetic axis of the earth.			Infers the magnetic axis of earth.

Dr A Amalraj
Prof A Dhasnavis
Prof M Jaganathan
Prof (Mrs) P Latha

LESSON PLAN

Name of the School :
Class : Std VIII
Name of the Teacher :

Period :
Duration : 40 minutes
Subject : Physics
Topic : Magnetism – Magnetic field due to a bar magnet

Instructional Objectives :

2. Understands the properties of magnets.
3. Acquires knowledge about magnetic field and magnetic lines of force around a bar magnet.
4. Applies the knowledge of magnetism to compare the magnetic axis of earth with geographical axis.
5. Develops skill in drawing / handling the apparatus.

Teaching Points :

1. Concept of magnetic field.
2. Mapping of magnetic field due to a bar magnet.
3. Properties of lines of force.

Materials Required :

Bar, magnet, iron filing, cardboard, compass needle

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation Items
Recalls that magnets are substances which attract iron.	What is a magnet ?	
Recalls north pole and south pole.	Name the two poles in a magnet.	
Recognises they attract each other.	Teacher brings north pole of a magnet near the south pole and asks students to observe.	
Infers that the force of attraction is less when the distance increases.	Teacher demonstrates by placing a bar magnet near iron nails and slowly takes it away from the magnet. The space around the magnet where the effect is felt is called magnetic field. Today let us study about the magnetic field.	What do you observe when the distance between the object and magnet decreases ?
Recognises the arrangements.	To perform the experiment, Teacher places a cardboard over the bar magnet and sprinkle iron filings and taps the cardboard.	What do you observe? How do you know that there is magnetic field?
Draws the magnetic field of a bar magnet.	Keeps a bar magnet on a white paper and draws the magnetic lines using compass needle. Teacher also explains – the lines of force is the path followed by a unit – north pole.	Draw similar lines placing the compass box at various points near the north pole.

Expected Learning Outcomes	Sequential Learning Experiences	Evaluation Items
Infers the properties of lines of force.	Teacher explains the properties that 1. The lines of force start from the north pole and end on the south pole. 2. The lines of force are found all around magnet. 3. Lines of force are crowded near the poles. 4. They do not cross each other.	Draw the magnetic lines of forces by keeping a bar magnet, north pole pointing north.

Review :

2. Define magnetic field.
3. Define magnetic lines of force.
4. What are the properties of lines of force around a bar magnet ?
5. What is the experiment to know the magnetic field around a bar magnet ?

Assignment and Pool of Questions :

1. What are lines of force ?
2. Describe the process of drawing magnetic lines of a bar magnet ?

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